

BARRIERS TO THE IMPLEMENTATION OF THE 2030 SAUDI VISIONS SUSTAINABLE CONSTRUCTION OBJECTIVES

Saeed Bahidrah* and Kasim A. Korkmaz

Eastern Michigan University
School of Visual and Built Environments, Ypsilanti, MI

E-mail: sbahidra@emich.edu
E-mail: kkorkmaz@emich.edu

ABSTRACT

Purpose: This research investigates the barriers preventing the implementation of green and sustainable practices in the Saudi Construction industry.

Design/Methodology/Approach: This research utilises a qualitative research approach, a case study. It relies on a comprehensive review of the literature of relevant journals in construction management to generate the findings of the study.

Findings: This research found that individual, organisational and project-specific variables prevent the implementation of green practices in the Saudi construction industry. Lack of awareness, training with respect to lean construction, and a dearth of top management support to the adoption and implementation of lean construction have all slowed down the penetration of lean construction into the construction industry in Saudi Arabia.

*Corresponding author

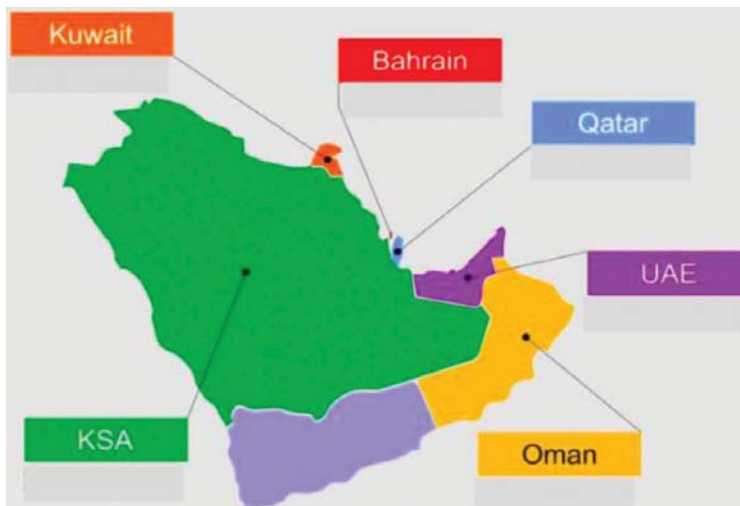
Original/Value: This study is the first systematic analysis of the determinants of lean construction challenges in Saudi Arabia. It presents practical recommendations, the administration of workshops to construction firms' employees, to increase their awareness and application of lean construction. It opens the door for more quantitative based research on factors facilitating the adoption of green construction models in the Kingdom.

Keywords: Lean construction; Sustainable development; Construction industry; Lean delivery systems; Gulf Cooperation Council (GCC); Middle eastern construction industry; Saudi Arabia.

Reference to this paper should be made as follows: Saeed Bahidrah and Kasim A. Korkmaz (2017) 'Barriers to the Implementation of the 2030 Saudi Visions Sustainable Construction Objectives', *Middle East Journal of Entrepreneurship, Leadership and Sustainable Development*, Vol. 1, No. 1, pp.033–042.

INTRODUCTION

The Saudi government has constructed a new vision for the country up to 2030. It is important for all Gulf Council Countries (GCC) (Figure 1). One of the defining features of stated vision is the incorporation of sustainable development in the country's public, as well as private, industries. The vision particularly emphasised the protection of the environment and the need to adopt cleaner forms of industrialisation, construction and service delivery. Amidst the shift towards sustainable development, the government aspires to make the country's construction industry cleaner, more cost-effective and efficient. This will be achieved through the encouragement and adoption of a series of measures, including lean construction, green buildings and better waste management.

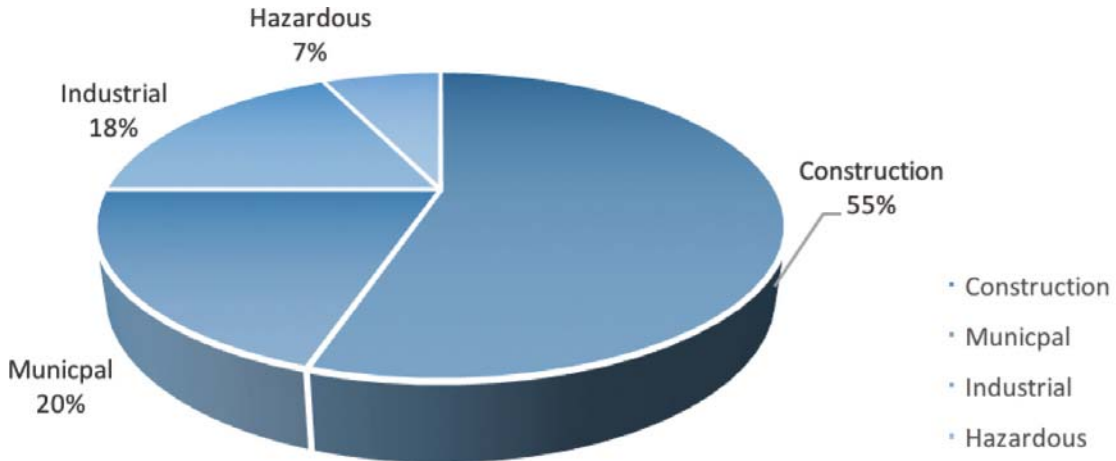


Source: Adapted from Morgan, 2016

Figure 1 Gulf Council Countries (GCC)

Lean construction has the potential to minimise costs; it can also increase efficiency and customers' satisfaction (Salem et al., 2006). It aims to eliminate the waste from every stage involved in a construction project by amplifying coordination, collaboration and teamwork to deliver projects on time (Kim and Park, 2006). The construction industry is responsible for over 50% of GCC's waste, including Saudi Arabia (Figure 2). All in all, lean construction has been proposed as a solution to the endemic problem of delays in the construction industry (Alarcón et al., 2011).

Despite its promise and immense benefits to the construction industry, lean construction has not yet penetrated most of the industry's elements (Salem et al., 2006). In addition to Lean Delivery Systems, the Last Planner System (LPS) has been incorporated into the management and execution of projects. However, the extent to which lean construction has influenced the global construction industry has been minimal (Kim and Park, 2006). The situation is worse in developing nations. For instance, Saudi Arabia, one of the fastest growing countries in the Middle East with a construction market worth more than \$50 billion, has recently made modest inroads in adopting green building practices, including lean construction (Alarcón et al., 2011).



Source: Adapted from Middle East Waste Summit (2009, p. 1)

Figure 2 Waste Types across GCC

The burgeoning literature on lean construction implementation notes the multiplicity of barriers to the incorporation of the concept into the construction industry (Sarhan and Fox, 2013). Those studies noted the existence of individual, organisational and project level factors preventing the application of lean construction concepts and practices (Sarhan and Fox, 2013; Kim and Jang, 2005). This paper outlines the conceptualisation of lean construction, barriers to its implementation in the construction industry, and the construction industry in Saudi Arabia. Due to the dearth of systematic research on lean construction application in construction projects in Saudi Arabia, this paper calls for future systematic research to investigate the number, intensity and effects of potential barriers to the implementation of lean construction, as well as green practices, within the construction industry in Saudi Arabia.

BACKGROUND

Sustainable Development

The World Commission on Environment and Development (WCED) referred to sustainable development as the simultaneous application of environmental quality, social equality and economic prosperity (Lele, 1991). In the past three decades, the focus on preserving the environment has increased exponentially, prompting private firms and governments to take tangible measures aimed at protecting the environment. This unprecedented concern for the environment originates from the interaction of the work of the anti-pollution drives globally, as well as the increased efforts by international organisations to care for mother earth due to the clear harmful ramifications of environmental problems (Hopwood et al., 2005).

This wave of environmental concern has penetrated the construction industry at a slower pace (Alarcón et al., 2011). The push for sustainable construction came as a consequence of the great harms and hazards the industry has on the environment. The construction industry is responsible for a great deal of CO₂ emissions and waste sent to landfill. To join the environmental movement, the construction industry has begun to adopt sustainable and green practices (Mehta, 2001).

Sustainable Construction

Sustainable constructions simply apply the principle of meeting the needs of the present without compromising those of the future to the construction industry. This simply means that construction projects should have less waste, consume less energy, but still possess the benefits they provide for today's, as well as future, uses. Sustainable construction incorporates aspects of economic efficiency, social responsibility, and, most importantly, environmental performance.

Sustainable construction entails the responsible and efficient design, management, maintenance and construction of both small and large projects. In doing so, many standards are met at every stage of the construction projects: principles of green buildings and lean construction are applied (Mehta, 2001). Processes, operations, and long-term monitoring protocols are instituted in order to maximise the implementation of sustainability throughout the construction process. In recent years, lean construction has made strides to become one of the most celebrated concepts and practices of sustainable construction.

Lean Construction

Lean construction comes from earlier conceptions of lean manufacturing and management. The Toyota production system envisioned by Ohno has set the stage for a production system with minimal waste that integrates all components of the system into an holistic framework. Koskela (1997) revamped the traditional construction production model with his transformational flow value generation model, aimed at minimising waste in the construction process. The late 1990s witnessed the emergence of new applications in the construction industry borrowed from lean manufacturing, represented by the Last Planner System and Lean Project Delivery System.

Lean construction refers to the elimination of waste at all stages in the construction process by reducing the non-value adding activities while increasing the value-adding ones. Simultaneously, lean construction refers to the maximisation of performance to the customer at all stages of the building project. According to Koskela (1997):

"Lean construction includes practice of just in time (JIT), use of pull-driven scheduling, reduction of variability in labour productivity, improvement of flow reliability, elimination of waste, simplification of the operation, and implementation of benchmarking".

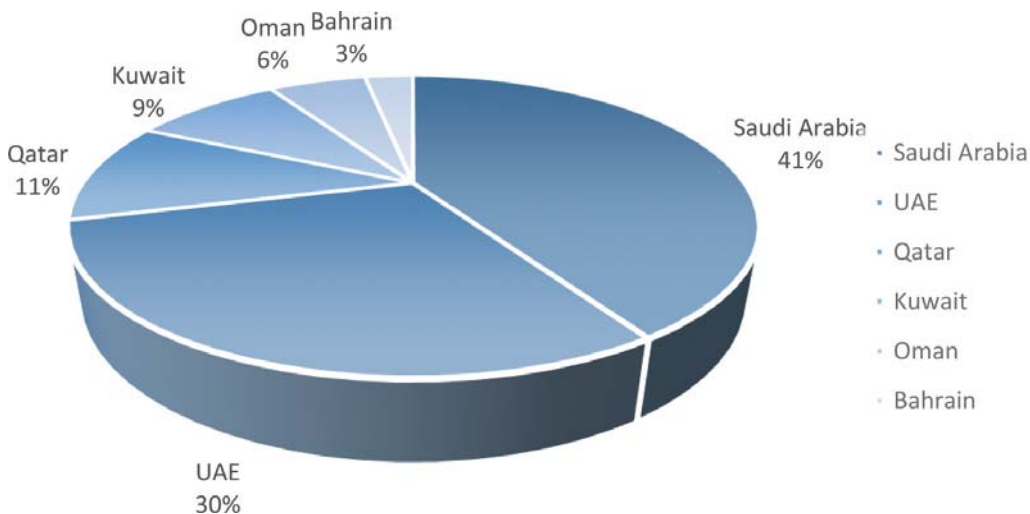
CASE STUDY

The Construction Industry in Saudi Arabia

Harris and McCaffer (2013) referred to the construction industry as all firms, organisations, associations and commissions participating in the development, management, maintenance

and demolition of buildings and built in the environment. The construction industry is composed of all activities contributing to the construction, planning and implementing buildings, as well as civil engineering projects (Harris and McCaffer, 2013).

The construction industry in Saudi Arabia is the biggest in the Gulf region, with 41% of the total development construction projects in GCC (Figure 3) (Forman, 2013). Of the construction projects (estimated at \$1.9 trillion in 2009) to be implemented in the Arabian Gulf, 25% are located within the Kingdom of Saudi Arabia. The largest contributor is the Saudi government, allocating a great deal of financial resources to revolutionise the country's infrastructure. The government has awarded a number of contracts to complete state-of-the-art projects, such as the Riyadh Metro System estimated at \$23 billion. In 2009 alone, the government paid approximately \$50 billion to complete 34 contracts. According to industry experts, the government of Saudi Arabia has spent over \$400 billion on construction projects since 2008 (USAB Council, 2011).



Source: Adapted from MEED Projects (Forman, 2013)

Figure 3 Development Construction Activity Across GCC

The construction industry is expected to grow as residential, commercial and governmental demands rise in the future; this is due to the annual population increase of 2.5%. The industry will also expand due to the expected implementation of the National Industrial Clusters Program and the development of Economic Cities. The construction industry is expected to remain large given the large allocations for construction projects reflected in the budgets during the past decade.

Lean Construction in Saudi Arabia

The scientific study of lean construction in Saudi Arabia is limited. One study noted that lean construction is still underdeveloped in Saudi Arabia. AlSehaimi et al. (2014) investigated the effect of LPS incorporation on the planning of construction projects. They concluded that overall planning and management improved throughout the life cycle of the projects. Nevertheless, they indicated that lean construction is still in its infancy in the kingdom's construction industry.

In an effort to incorporate green building and lean construction into the construction industry in Saudi Arabia, the government established the Green Building Forum, fostering principles and practices of sustainable construction. Despite its success by announcing the building of many green projects, most of the forum's contracts have been placed on hold for non-compliance with the set criteria by the organisation. Secretary of the forum, Faisal Alfadl, stated "The work is on at about 400 projects for green buildings across the Kingdom and 50 per cent of them are delayed because of the lack of clarity, application of the green building concept to the owner, the consultant and the contractor."

The Saudi market for green buildings has dramatically increased; it is estimated at 15% of the total number of green projects in the Middle East. This outgrowth in green buildings is unmatched with the application of lean construction principles and practices. Systematic research on the barriers leading to the lack of implementation of standards of lean construction in green buildings is still a developing area of research, and non-existent with respect to the Saudi case.

FINDINGS

Barriers to Lean Construction

The study of lean construction applications in construction industries around the world has been limited. Few analyses have explored the barriers preventing the industry from adopting the principles and practices of lean construction in the UK, Malaysia, Uganda and the US. Earlier research from Chile reported that the lack of training, feedback, time constraints and organisational characteristics challenged the implementation of lean construction. Other analyses noted the importance of lean construction awareness, especially with concepts associated with LPS, weak communication, and failure to create learning cycles as notable barriers to the implementation of lean construction.

Another main hindrance to the application of lean construction is individuals' attitudes towards the efficiency and usefulness of green practices in construction projects. Therefore, barriers to lean construction implementation can be at the individual level, organisational or project-specific. Barriers for Lean Construction Implementation can be seen in Table 1.

Table 1 Barriers for Lean Construction Implementation

<i>Barrier Type</i>	<i>Barrier</i>
Individual Level	Lack of understanding regarding lean construction Lack of lean construction education
Organisational Level	Lack of top management support Lack of training Refusal to change
Project Level	Weak channels of communications Lack of teamwork

Source: Developed by the Author

Lack of Top Management Support

Kim and Park (2006) concluded that organisational support proves vital in the implementation of lean construction in the design, execution, and management of projects. The lack of top management support for any given practice in organisations signals the marginal utility of such concepts or practices. This, in turn, leads to non-compliance with practices disenfranchised by management. Therefore, lean construction must be enshrined in management practices at all stages of the project in order for it to be successful in any given market.

Inadequate Understanding of Lean Construction

Lean construction originated within the lean manufacturing framework. Therefore, both concepts share a great deal of similarities; to understand lean construction one needs to begin with lean manufacturing. The construction process is, at best, complex, containing multiple stages and elements. Lean construction as an alternative production plan applies to all stages throughout the process. A difficulty facing the implementation of lean construction is set by the failure of the parties in a construction project to adequately comprehend the concepts and practices of lean manufacturing. The lack of understanding of how to apply concepts of lean manufacturing to construction projects forms a hindrance in implementing lean construction.

Lack of Awareness

Unlike lean manufacturing, where firms and organisations are active in raising awareness for principles of efficiency and optimisation, the public, as well as private industries, lack awareness when considering lean construction. Few of the existing industries, such as those in the United States and the United Kingdom, have established programmes to increase the exposure of construction industry players to the benefits and gains of lean construction. Without proper training, construction firms and their employees will be unable to harness the great advantages presented with lean construction.

Lack of Technical Training

Similar to the successful implementation of other technologies and principles, lean construction requires adequate training. First, construction sectors' players need to understand the concepts and principles of lean construction, an educational phase. Second, and more importantly, technical training in the necessary tools utilised in the industry needs to be provided. This includes training in information systems used in managing projects, optimisation tools used in the productivity phases, and other project-specific technologies.

Weak Channels of Communications

Delays form the biggest threat to construction projects. Delays result from a number of factors, mainly weak communications. Construction projects require the coordination of many efforts with numerous players, clients, contractors, and managers. Coordination at all levels at all times is necessary in order to guarantee the highest possible chance to complete the project on time. One of the most important principles preached by lean construction is the minimisation of waste. One form of waste is unwanted or unnecessary

communication channels. The multiplicity of actors within construction projects introduces a great number of communication channels, presenting a barrier to the implementation of lean construction.

Refusal to Change

Construction firms are private sector actors that aim to maximise profits while completing projects on time and with the highest levels of customer satisfaction. The introduction of lean construction into the construction process should be in line with this philosophy, since lean construction eliminates waste, minimises costs, and achieves higher levels of satisfaction. Nevertheless, construction firms may feel comfortable with their existing management systems that deliver the project on time and satisfy the consumer.

Inadequate Teamwork

It appears from earlier that adequate levels of communications are necessary when it comes to implementing lean construction. Since the construction project requires a great deal of teamwork from all parties, the coordination and management of the workflow among all teams becomes essential for the successful implementation of lean construction. Therefore, management and logistics constitute important factors in the lean construction application.

Attitudes

Psychological studies noted attitudes regarding certain behaviour influence the chances of engaging in such behaviour. To implement lean construction, the construction project parties need to have favourable attitudes regarding the principle and practice. It appears from the previous discussion that many players within the construction industry still believe that lean construction may not be the best choice in delivering projects for a variety of reasons.

CONCLUSIONS

Lean construction is a promising system aimed at preserving the environment, minimising waste and increasing projects' efficiency. It has been applied in many contexts and proved to be a working solution to the sustainability challenge, as well as delays. Nevertheless, the implementation of lean construction is still limited, especially among developing nations. This paper outlined the most commonly cited factors affecting the application of lean construction concepts and practices. These included individual, organisational and project specific characteristics preventing lean construction from penetrating into all stages of the construction process. This research calls for an empirical investigation of the challenges for lean construction in Saudi Arabia.

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BIOGRAPHICAL NOTES

Saeed Bahidrah is a doctoral student at Eastern Michigan University's programme in Technology, majoring in construction management. He is interested in lean construction, sustainability and green buildings. He is currently working on his dissertation on the factors predicting construction firms' employees' likelihood of adopting green building practices. He holds a Masters' degree in construction management from Eastern Michigan University. Saeed Bahidrah is also an active member of green building societies where he has been involved with the Saudi Green Buildings Council. He is conducting research projects aimed at increasing the frequency and intensity of green building practices in the Middle East.

Kasim Korkmaz is an Assistant Professor of Eastern Michigan University. Dr Korkmaz's expertise is in Civil Engineering and Construction Management. He has published several papers and reports in related areas, and has several research projects on related areas of the sustainability and green practices of constructed facilities and infrastructure from concept to maintenance. He has completed research projects on sustainable practices in highway construction. In his research, he has been in charge of all facets of all the research projects, including overall experiment design, designing data collection plans, design and implementation of observational data collection plans, and design.